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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

**SUSQUEHANNA STEAM ELECTRIC STATION
LICENSEE EVENT REPORT 50-388/2012-003-01
UNIT 2 LICENSE NO. NPF-22
PLA-7086**

Docket No 50-388

*Reference: PLA-6974: Susquehanna Steam Electric Station Licensee Event Report
50-388/2012-003-00 Unit 2 License No. NPF-22, dated February 14, 2013.*

Attached is supplemental Licensee Event Report (LER) 50-388/2012-003-01. On December 16, 2012, at approximately 0156 hours, the Susquehanna Steam Electric Station (SSES) Unit 2 reactor automatically scrambled during the performance of quarterly Unit 2 main turbine control valve testing. This event was determined to be reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A) for an event that resulted in the automatic actuation of the Reactor Protection System, Reactor Core Isolation Cooling and the High Pressure Coolant Injection system.

At the time the original LER (Reference) was submitted, the cause of the secondary reactor scram had not been determined. A root cause analysis has been completed and this supplement provides revised information regarding the causes and completed corrective actions. Additional clarifying information has also been included in the attached LER. In accordance with NUREG-1022, Revision 3, Section 5.1.5, "Supplemental Information and Revised LERs," revision bars are included to indicate where supplementary information has been added.

There were no actual consequences to the health and safety of the public as a result of these events.

No commitments were identified in this submittal.


J. A. Franke

Attachment: LER 50-388/2012-003-01

Copy: NRC Region I
Mr. J. Greives, NRC Sr. Resident Inspector
Mr. J. Whited, NRC Project Manager
Mr. L. Winker, PA DEP/BRP

LICENSEE EVENT REPORT (LER)

(See reverse for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME

Susquehanna Steam Electric Station Unit 2

2. DOCKET NUMBER

05000388

3. PAGE

1 OF 5

4. TITLE

Unit 2 Automatic Reactor Scram While Performing Turbine Control Valve Surveillance Testing

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
12	16	2012	2012	- 003 -	01	10	04	2013	FACILITY NAME	DOCKET NUMBER
										05000
									FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

1

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)

- | | | | |
|---|---|--|--|
| <input type="checkbox"/> 20.2201(b) | <input type="checkbox"/> 20.2203(a)(3)(i) | <input type="checkbox"/> 50.73(a)(2)(i)(C) | <input type="checkbox"/> 50.73(a)(2)(vii) |
| <input type="checkbox"/> 20.2201(d) | <input type="checkbox"/> 20.2203(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(viii)(A) |
| <input type="checkbox"/> 20.2203(a)(1) | <input type="checkbox"/> 20.2203(a)(4) | <input type="checkbox"/> 50.73(a)(2)(ii)(B) | <input type="checkbox"/> 50.73(a)(2)(viii)(B) |
| <input type="checkbox"/> 20.2203(a)(2)(i) | <input type="checkbox"/> 50.36(c)(1)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(iii) | <input type="checkbox"/> 50.73(a)(2)(ix)(A) |
| <input type="checkbox"/> 20.2203(a)(2)(ii) | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x) |
| <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2) | <input type="checkbox"/> 50.73(a)(2)(v)(A) | <input type="checkbox"/> 73.71(a)(4) |
| <input type="checkbox"/> 20.2203(a)(2)(iv) | <input type="checkbox"/> 50.46(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(v)(B) | <input type="checkbox"/> 73.71(a)(5) |
| <input type="checkbox"/> 20.2203(a)(2)(v) | <input type="checkbox"/> 50.73(a)(2)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(v)(C) | <input type="checkbox"/> OTHER |
| <input type="checkbox"/> 20.2203(a)(2)(vi) | <input type="checkbox"/> 50.73(a)(2)(i)(B) | <input type="checkbox"/> 50.73(a)(2)(v)(D) | Specify in Abstract below
or in NRC Form 366A |

10. POWER LEVEL

98%

12. LICENSEE CONTACT FOR THIS LER

Facility Name

Brenda W. O'Rourke, Senior Engineer - Nuclear Regulatory Affairs

Telephone Number (Include Area Code)

(570) 542-1791

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE)☒ NO

15. EXPECTED SUBMISSION DATE

MONTH DAY YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On December 16, 2012, at approximately 0156 hours, the Susquehanna Steam Electric Station (SSES) Unit 2 reactor automatically scrambled during the performance of quarterly channel functional test of the turbine control valve (CV) fast closure channels of the Reactor Protection System (RPS). Both the High Pressure Cooling Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) systems automatically initiated and injected water into the reactor vessel. At approximately 0210 hours on December 16, 2012, a second reactor scram signal was received due to reactor water level lowering to +13 inches. This LER is being submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A) for an event or condition that resulted in the automatic actuation of the RPS, and the HPCI and RCIC systems.

0156 hours Scram - No direct cause of the unexpected Division 1 scram signal was identified. This conclusion is based on laboratory results from the disassembly and inspection of the #1 Turbine CV. The root cause of the scram was SSES failed to incorporate industry best practices with other impacted work groups for half scram reduction. 0210 hours Scram - The root causes are: The ICS design control value of +18 inches for setpoint setdown did not provide adequate margin to prevent operational overlap with the RPS low level scram setpoint of +15 inches; and the ICS reactor water level setpoint setdown was not reset prior to raising the ICS reactor water level

Key completed corrective actions include: replaced the Unit 1 CV #1 Fast Acting Solenoid Valve and Shutoff Valve; revised the Unit 1 and 2 quarterly turbine valve cycling surveillance procedure to require the use of an RPS test box; inspected all four Unit 1 Fast Acting Solenoid Valves for secure butt splice connections; revised ON-100(200)-101 to specify reactor water level band that would not create a reactor low water level scram; revised OP-245-001 and hard card OP-245-001-01 to provide direction for resetting the ICS setpoint setdown. Key planned corrective action: provide training to all operators on specific lessons learned as they pertain to reactor level control. Include this training in initial license and licensed operator requal training. There were no actual consequences to the health and safety of the public as a result of this event.

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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Susquehanna Steam Electric Station Unit 2	05000388	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 5
		2012	-003-	01	

NARRATIVE**CONDITIONS PRIOR TO THE EVENT**

Unit 1 - Mode 1, 100 percent Rated Thermal Power
Unit 2 - Mode 1, 98 percent Rated Thermal Power

EVENT DESCRIPTION

On December 16, 2012, at approximately 0156 hours, the Susquehanna Steam Electric Station (SSES) Unit 2 reactor automatically scrammed during the performance of Technical Specification (TS) surveillance testing of the #2 turbine control valve (CV). The test being performed was the quarterly channel functional test of the turbine CV fast closure channels of the Reactor Protection System (RPS). At 0151 hours, the #4 CV was tested and a Division 2 half-scram signal was received and cleared as expected. At 0153, CV #1 was tested, but was aborted due to nail meter glare. At 0153 hours, the CV #1 test was successfully completed. At 0155 hours, during testing of the #2 CV, a RPS half-scram was received as expected (specifically, the 'B' channel, Division 2 of RPS). Prior to the Division 2 scram signal clearing, an unexpected momentary Division 1 ('A' channel of RPS) scram signal was also received from the CV #1 fast closure signal, resulting in a full RPS reactor scram.

All control rods fully inserted, with two control rods inserting beyond position "00" following reset of the reactor scram. Both reactor recirculation pumps tripped at -38 inches. All containment isolations occurred as expected. Both the High Pressure Cooling Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) systems automatically initiated and injected water into the reactor vessel but were overridden by the control room operators once reactor water level was restored above the HPCI and RCIC initiation setpoints. The scram was reset to aid in preventing reactor vessel thermal stratification.

At approximately 0210 hours on December 16, 2012, a secondary scram occurred on reactor low water level (+15 inches). This occurred when operations attempted to raise the Feedwater Integrated Control System (ICS) reactor water level setpoint setdown value from +18 inches to +35 inches. However, reactor water level lowered to the scram setpoint, resulting in a second reactor scram signal. No control rod motion occurred, as all rods were inserted.

There were no safety relief valve actuations or emergency diesel generator starts during the event. Reactor pressure was controlled via turbine bypass valve operation. There were no structures, systems, or components that were inoperable at the start of the event that contributed to this event.

In accordance with 10 CFR 50.72(b)(2)(iv)(A) and 10 CFR 50.72(b)(2)(iv)(B), on December 16, 2012, a 4-hour ENS notification (# 48598) was made to the NRC for an event or condition that results in Emergency Core Cooling Systems (ECCS) discharge into the reactor coolant system as a result of a valid signal, and any event or condition that results in the actuation of the RPS when the reactor is critical, respectively. This event was also reportable as an 8-hour notification in accordance with 10 CFR 50.72(b)(3)(iv)(A) for any event or condition that resulted in a valid actuation of the RPS, and the HPCI and RCIC systems.

This LER is being submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A) for an event or condition that resulted in the automatic actuation of the RPS, and the HPCI and RCIC systems.

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CAUSE OF THE EVENT

Scram #1:

No direct cause of the unexpected Division 1 scram signal was identified. This conclusion is based on laboratory results from the disassembly and inspection of the #1 Turbine CV.

The root cause of the event was SSES failed to incorporate industry best practices with other impacted work groups (Operations) for half scram reduction. Specifically, Dresden OE (from 2000) regarding the station's success in reducing the number of half scram by using an RPS test box, and the 2005 Boiling Water Reactor Owners Group (BWROG) scram reduction effort, Recommendation #30 regarding the use of a test box to reduce RPS half-scram signals. An RPS test box allows testing of a scram contactor without actualizing the contactor and creating a half scram. SSES's evaluation of the above OE recommendations did not recognize the OE's applicability to operations surveillance test procedures.

The following two causal factor also contributed to the event:

Causal Factor 1 – Poor maintenance practices related to insulation stripping and connection crimping created resistance leading to less than designed power applied to the solenoid coil.

Causal Factor 2 – Failure to incorporate GE SIL 226 (from 1977) recommendations for adequate wait time between testing into the SSES Quarterly Turbine Valve Cycling surveillance procedures.

Scram #2:

A root cause analysis was performed to evaluate the cause(s) of the second reactor low water level scram event. The analysis identified the following two root causes:

- Step 10 of procedure OP-245-001, "RFP and RFP Lube Oil System," was not performed. Step 10 directs the operator to reset the ICS reactor water level setpoint setdown prior to raising the ICS reactor water level from +18 inches to +35 inches (Step 11). Because Step 10 was not completed, when Step 11 was performed, reactor water level could not be raised.
- The ICS design control value of +18 inches for setpoint setdown did not provide adequate margin to prevent operational overlap with the RPS low level scram setpoint of +15 inches. This lack of margin was the result of design requirements not being aligned with post scram expectations from NRC PI IE04, "Unplanned Scrams with Complications."

ANALYSIS / SAFETY SIGNIFICANCE

Actual Consequences

All control rods inserted and both reactor recirculation pumps tripped at -38 inches. HPCI and RCIC both automatically initiated as expected. No steam relief valves opened.

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Potential Consequences

The Unit 2 risk significance and potential consequences for the initiating event experienced on December 16, 2012 due to an RPS automatic scram non-isolation event was less than 1E-06 for Core Damage Probability (CDP) and 1E-07 for Large Early Release Probability (LERP) significance thresholds as defined in NRC Inspection Manual Chapter (IMC) 609. These thresholds represent a Green significance level which is of "Very Low Safety Significance."

In summary, there were no actual consequences to the health and safety of the public as a result of the event.

CORRECTIVE ACTIONS

Key Completed Actions

Scram #1:

- Revised the Unit 1 and 2 Quarterly Turbine Valve Cycling surveillance procedures to require the use of an RPS test box when performing Main Turbine Control Valve Testing.
- Replaced the Unit 1 CV #1 Fast Acting Solenoid Valve and Shutoff Valve.
- Revised OE procedures to ensure condition reports are initiated when there is risk identified in OE that may impact SSSES.
- Inspected all four Unit 1 Fast Acting Solenoid Valves (FASV) for secure butt splice connections.
- Revised the Unit 1 and 2 Quarterly Turbine Valve Cycling surveillance procedures to require a 3-minute wait time between tests.
- Revised MT-GE-010 sections 5.20 and 5.21 to incorporate industry accepted tug test to ensure connection is mechanically secure.

Scram #2:

- Revised ON-100(200)-101 to specify reactor water level bands that would not create a reactor low water level scram.
- Revised procedure OP-245-001 and hard card OP-245-001-01 to provide direction for resetting the ICS setpoint setdown.
- Revised ON-100(200)-101 to direct closing of the accumulator charging water isolation valve to mitigate thermal stratification. This action will delay time to stratification and thus reduce the immediate need to reset the scram.

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- Completed training for all licensed operators to reinforce behaviors that would help prevent decisions that result in second scrams.
- Evaluated the differences between the simulator and the plant level trip setpoint and reprogramed the simulator loads with RPV level trip setpoints that are more conservative than the actual setpoints in the plant.
- Aligned Operations department standard for procedure place-keeping to site standard.
- Revised the level control strategy after the scram (reset of setpoint setdown) to prevent repeat Level 3 scrams.
- Provided training to all operators on specific lessons learned as they pertain to reactor level control. Include this training in initial license and licensed operator requal training.
- Implemented a change to the Unit 1 & 2 ICS setpoint setdown to raise the setpoint from + 18 inches to + 22 inches.

Key Planned Corrective Actions:

- Revise procedure MFP-QA-1220 to ensure that necessary design considerations are in place to avoid or mitigate post-scram complications

Previous Similar Events:

None